Research & Development

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R&D funding forecast

Materials and technology for communications

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Research & Development

SERVING THE $202-BILLION WORLDWIDE R&D INDUSTRY

ABOUT THE COVER

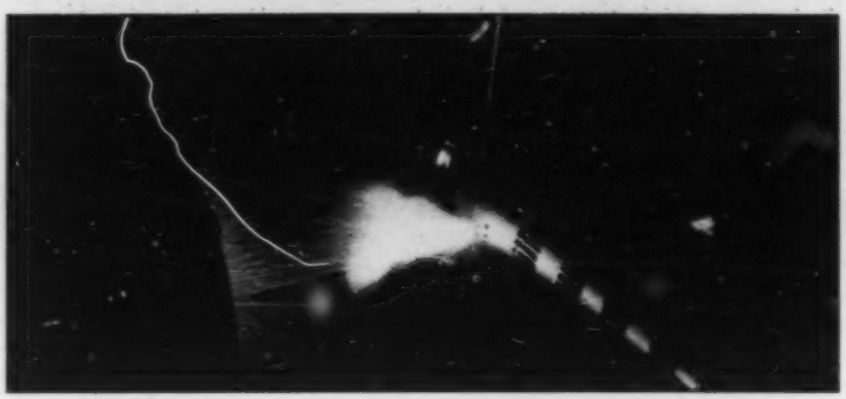
Laser comes of age

On May 15, 1960, Dr. Theodore H. Maiman unveiled the first working laser. Unlike many inventors, Maiman, presently a member of *R&D*'s Editorial Advisory Board, did foresee applications that only now, in this 25th anniversary year, are becoming realities.

For example, the fastest-growing application for General Laser Corp.'s line of axial-type CO_2 lasers is in metal cutting, as shown on the cover. Other large-scale applications are in welding and in heat-treating operations.

The laser fireworks at right appear in the laser-assisted machining of advanced alloys at General Electric's R&D Center. In attempts to improve productivity and to reduce costs in machining of titanium alloys, researchers are firing a YAG laser at rates as high as 300 pulses/sec. After this treatment, conventional tools can remove material at high operating speeds from the treated areas.

While the reputation of lasers' effectiveness has been based on exotic applications in medicine, electronics, and scientific research, the capabilities of lasers eventually will turn them into workhorses in numerous process applications.



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R&D funding will rise to $110 billion in 1985

Our annual forecast finds planned funding going up by 13.4% overall. Federal funding increase leads the way, but industry still is major source of dollars.

C.J. Mosbacher
Executive editor, *R&D*

NO RECESSION FOR R&D. That's the 1985 scenario based on the studies leading to our forecast of $110 billion total funding for this year.

Compare that to the total United States economy. The consensus of economic studies in late November called for real growth in the gross national product (GNP) of 3 to 5% in 1985. Inflation is expected to stay low at 4 to 5%. Thus total growth of 7 to 10% is foreseen in the year ahead, barring calamity.

But, again barring calamity and using a revision of our 1984 forecast as a base, R&D funding should rise 13.4%. The implication is that the proportion of GNP spent on R&D will continue to increase, as it has each year since 1978. In 1984, 2.7% of GNP was spent on R&D in the United States.

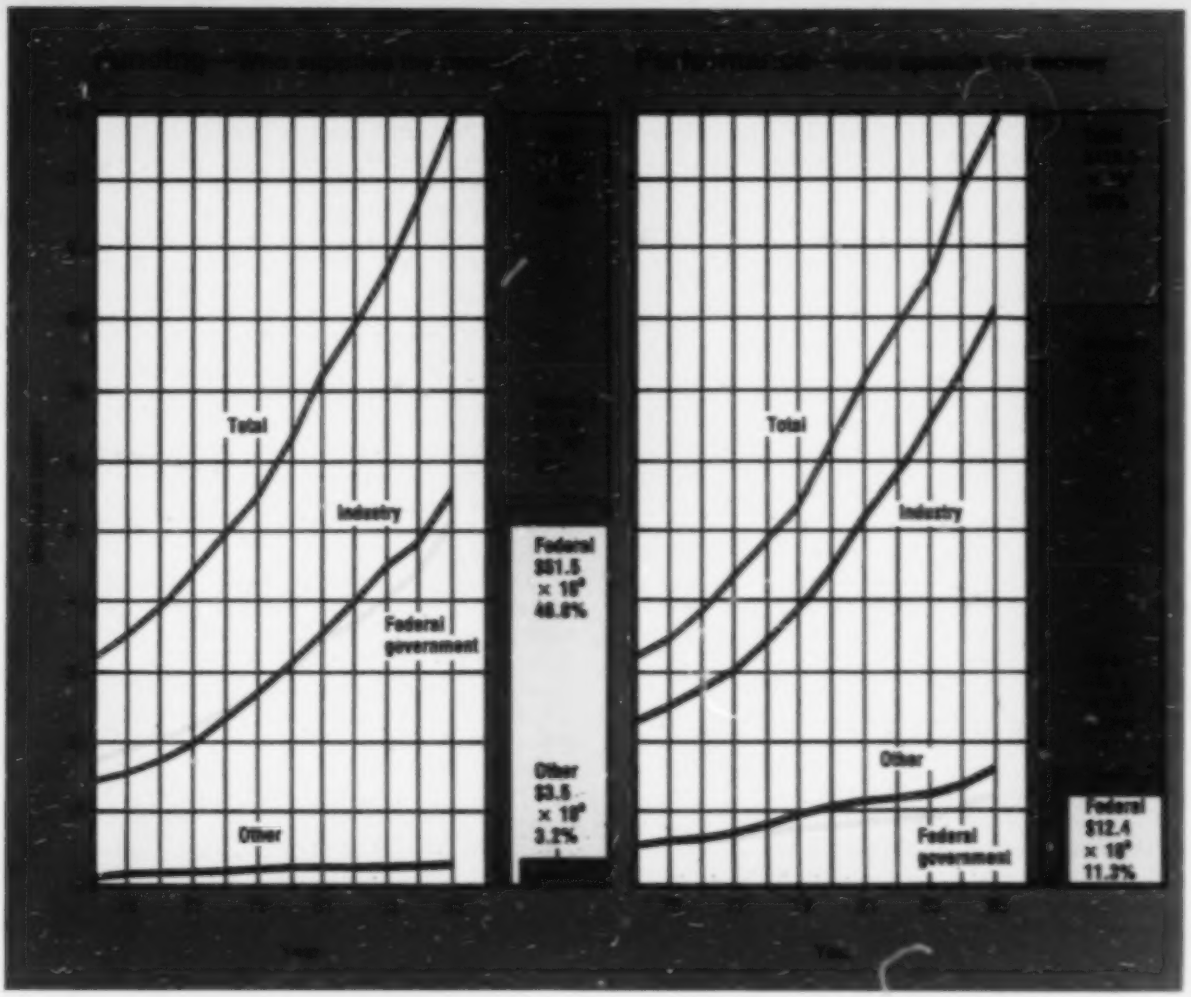
That percentage comes from "National patterns of science and technology resources 1984," NSF 84-311, the latest overall data on R&D funding from the National Science Foundation. While distributed last fall, its foreword is dated February 1984. According to this document, total R&D funds for 1984 were estimated at $96.975 billion, with the Federal government providing $44.270 billion, industry $49.375 billion, and universities and nonprofit organizations $3.330 billion.

The performance profile, or who spent these 1984 funds, is given as $10.800 billion in Federal government laboratories and R&D centers, $72.000 billion by industry in its own facilities, and $11.375 billion by universities and their associated research centers and $2.800 billion by other nonprofit institutions, giving a total of $14.175 billion.

NSF also estimated that 12% would be spent in 1984 on basic research, 22% on applied research, and 66% on development.

In our January 1984 forecast, we projected total funding for 1984 as $97.8 billion, with $50.5 billion provided by industry, $44.5 billion by the Federal government, and $2.8 billion by other sectors including academic and nonprofit organizations. Our performance projections were expenditures in industry of $73.9 billion, in Federal facilities of $10.5 billion, and in other sectors of $13.4 billion.

In addition to NSF 84-311, we also considered later data in revising our 1984 forecast to provide a basis for this 1985 forecast. We checked changes in Federal funding as monies appropriated by the Congress were obligated to specific projects and then were actually spent. We monitored changes in plans made by industry as revealed in financial reports and other documents and in conversations with executives in a number of companies. And we also monitored and checked leaders in academic and other nonprofit organizations. These procedures lead not only to the revised 1984 base but also give insights that aid our forecast.



Our revised base for 1984 gives a total of $97.0 billion for R&D funding. Industry provided $49.0 billion, the Federal government $44.7 billion, and other sectors $3.3 billion. Thus industry provided 50.5% of 1984 funds, the Federal government 46.1%, and other sectors 3.4%.

Revised performance data for 1984 are $72.0 billion for industry, $10.8 billion for Federal facilities, and $14.2 billion for other sectors. Thus industry spent 74.2% of available funds, Federal facilities 11.1%, and other sectors 14.6%.

While the revision in total funds is less than 1%, changes in the categories range from 2.5% to more than 21% in the smaller funding and performance levels for the academic and nonprofit sectors. What caused these changes from our earlier view and how we arrived at the sector levels of expenditures and performance forecast for 1985 that are shown graphically at the beginning of this article will be discussed sector by sector in the following paragraphs.

Incidentally, had we not revised our 1984 data, we would show a 12.47% increase in 1985 funding.

Industry spreads its support

By last June, NSF had received replies from 87 companies representing an estimated 53% of all R&D industrial funding in the United States. Projections based on data received were $49 billion of company funds to be spent in 1984 and $55 billion in 1985. (These data are reported in "Science resources studies highlights," NSF 84-329.)

Our discussions with executives in a somewhat smaller group of companies chosen to balance those that fund R&D cyclically with the economy against the countercyclical segment provided similar data—so close, in fact, that our industry figures round to the same as NSF's. An increase of 12.3% in funding and 12.8% in expenditure levels from 1984 to 1985 is indicated.

However, that does not mean that industry is putting more funds into its own facilities than into other sectors. The opposite is true. Late in 1983 the law was changed to remove major restrictions on cooperative R&D, allowing industry to form such new groups as the Semiconductor Research Foundation. This change also allowed nonprofit organizations such as Battelle to seek wider support for cooperative projects.

Industry also is expanding its funding of R&D in the academic area, continuing a trend from 1983.

NSF 84-329 also provides breakdowns of company funds to be spent in 1984 and 1985. For 1985, chemicals and allied products account for $9 billion, machinery (including computers) $10 billion, electrical equipment $11 billion, motor vehicles and their equipment $6 bil-

lion, aircraft and missiles $5 billion, professional and scientific instruments $5 billion, and all other segments $9 billion.

For 1984, the comparable estimates are, in billions, $8, $9, $10, $5, $4, $4, and $9. The largest increase, 17%, is in the professional and scientific instruments sector.

To summarize, we expect industry funding to rise from $49 billion in 1984 to $55 billion in 1985, with industry providing 50% of all R&D funds in 1985. Industry performance will rise from $72.0 billion to $81.2 billion so that industry will spend 73.8% of all R&D funds in 1985, down slightly from 74.2% in 1984.

Federal funding up significantly

Our forecast is that actual Federal funding for 1985 will increase 15.2% from 1984 to $51.5 billion. Performance in Federal facilities will rise 14.8% to $12.4 billion.

Such a large increase was not evident early last fall as the Congress and the Administration battled over acceptable levels for appropriations. NSF was the beneficiary of an early budget decision and appropriation with a significant increase. The National Institutes of Health benefitted from an appropriations bill that significantly increased funding, primarily because a companion piece of legislation provided for expansion of the number of NIH institutes. While President Reagan vetoed the expansion, he approved the appropriations measure, thus giving NIH more money for grants and other programs. For example, money for AIDs research was increased significantly.

But most government funding was provided by an omnibus appropriations bill at the last minute that gave the Administration much of what it had asked for in its original requests for R&D funding, plus additional amounts that the Congress tacked on. Thus a more than 20% increase in Dept. of Defense-sponsored R&D survived, for example.

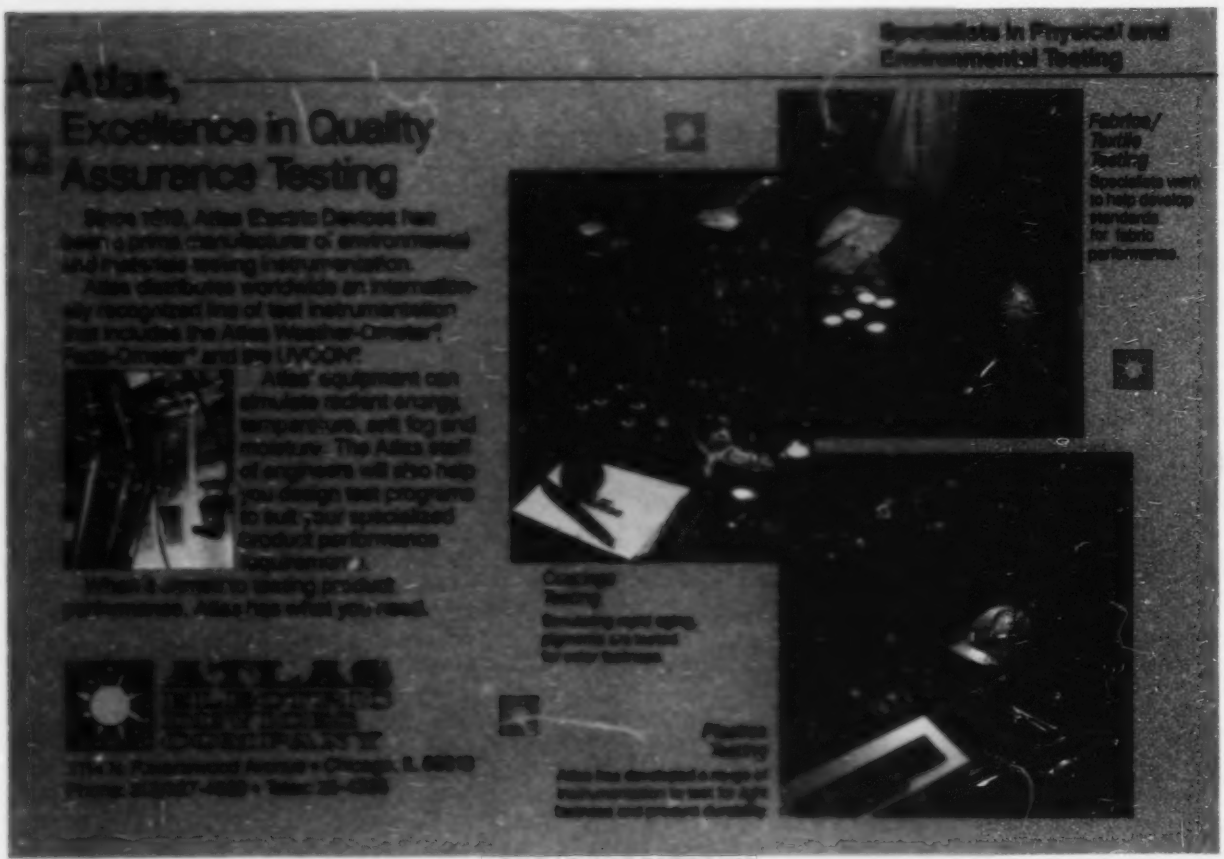
Thus, the Federal government will account for 46.8% of total funding in 1985, somewhat more than the 46.1% in 1984. In performance, the Federal share of the total rises from 11.1% to 11.3%.

Universities and nonprofits gain

Funds provided by other sectors rise only 6.1%, from $3.3 billion in 1984 to $3.5 billion in 1985. However, performance in these sectors really jumps, from $14.2 billion in 1984 to $16.4 billion in 1985. That is a 15.4% increase, leading to these sectors rising to 14.9% of performance in 1985 from 14.6% in 1984 while their actual contributions fall from 3.4% to 3.2% of total funding.

As noted earlier in the industry section, transfers of funds to cooperative R&D projects are creating more activity in the academic and nonprofit sectors. When Federal funding increases are added, the effect is a significant jump in performance levels.

The overall result? No recession for R&D. It would take a significant slowdown in industrial activity coupled with a virtual elimination of R&D funding by the Federal government in its fiscal 1986 budget to make R&D funds decrease in 1985. The probability of that, in our opinion, is zero. R&D



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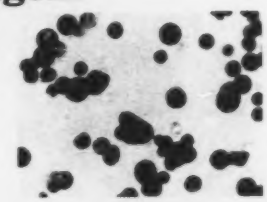

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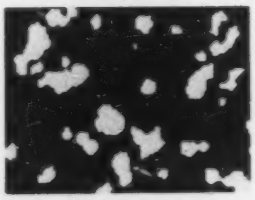

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OPINION POLL RESULTS

Pollution problems decline, aided by R&D staff efforts

POLLUTION is less severe in many parts of the world than it was in 1977, according to the nearly 2,000 respondents to our recent Opinion Poll survey on this subject. Currently, 24% believe that air pollution is fairly bad or severe in and near where they work, compared to 36% in 1977.

And, as might be expected, in many plants and institutions, it is the R&D people who are asked most often to help control pollution problems.

Some comparisons with 1977 and complete results of the current survey are shown below.

1. How severe is air pollution in and near where you work?

	1984	1977		1984	1977
a. Serious	6%	12%	c. Not very bad	50%	42%
b. Fairly bad	18	24	d. Hardly any	26	22

2. How severe is water pollution in and near where you work?

a. Serious	6%	9%	c. Not very bad	51%	46%
b. Fairly bad	24	30	d. Hardly any	19	15

3. How severe is noise pollution in and near where you work?

a. Serious	4%	7%	c. Not very bad	47%	48%
b. Fairly bad	20	22	d. Hardly any	29	23

4. Are you personally involved in pollution research or control?

a. Yes ..... 27% b. No* 73%

*(If no, please skip to question No. 9.)

5. In which of the following pollution research or control areas are you involved?

a. Water	34%	c. Noise	3%
b. Air	15	d. More than one	48

6. Do you work for . . .

a. Pollution control dept.	9%	d. Safety dept.	2%
b. Plant engineer	4	e. Quality control	9
c. R&D staff	43	f. Outside consultant	10
		g. Other	23

7. Which of the following items do you use in pollution control work?

a. Analyzing/testing instruments	9%
b. Monitoring instruments	3
c. Chemicals and materials	5
d. Control instruments	1
e. Some of the above	44
f. All of the above	34
g. None of the above	4

8. Do you get pollution control information primarily from . . .

a. Short courses	5%	c. Trade journals	53%
b. Conferences	10	d. Other	32

9. Does your company or organization have air, water, or noise pollution problems that, if not attended to, would become nuisances?

a. Yes . . . 50% b. No . . . 34% c. Don't know . . . 16%

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